

PATENT

KE-US040474

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Attn: Mail Stop Amendment
Hidesato MANO	:	Patent Art Unit: 1791
Serial No. 10/533,137	:	Examiner: Galen H. HAUTH
Filed: April 29, 2005	:	Confirmation No. 2300
For: RESIN COMPOSITION, TRANSFER MATERIAL AND PROCESS FOR PRODUCING SHAPED ITEM	:	

DECLARATION OF HIROYUKI HOSOI
UNDER 37 CFR § 1.132

1. I, Hiroyuki Hosoi, hereby unequivocally stipulate and declare that the following statements of facts are true and correct:

2. I received the degree of Master of Synthetic Organic Chemistry in March 1989 from Doshisha University postgraduate research institute Japan. I have been employed by Kyoeisha Chemical Co., Ltd. since 1989, where I hold a position in the Development Department, with responsibility for synthesis and application research of photosensitive resins such as functional monomers, oligomers and polymers.

3. I have reviewed and understand the claims and specification of the above application and the substance of the rejections in the Office Action of October 25, 2010.

4. Claim 1 of the instant application recites that a chelate compound is used as a heat curing agent for the polymer having a specific structure, i.e. a polymer having a (meth)acryl equivalent of 100 to 300 g/eq, a hydroxyl value of 50 to 550 mg KOH/g, an epoxy equivalent of 7000 g/eq or more, and a weight-average molecular weight of 5000 to 100000, the polymer being a reaction product of the addition of a monocarboxylic acid having an unsaturated double bond to a polymer having an epoxy group. Claim 1 also recites that the heat-curing agent be *free* of compounds containing one or more isocyanate groups.

5. U.S. Patent No. 6,245,182 (hereinafter the "Nakamura patent") teaches an isocyanate having a urethane bond amount of 6000 to 5000 g/eq.

6. Newly cited U.S. Patent No. 5,705,451 (hereinafter the "Takeo patent") teaches a hydroxyl group that can include an isocyanate or chelate compound for crosslinking (see Column 5 line 55 thru Column 6 line 10, etc.). The Takeo patent fails to disclose or suggest any difference between the use either an isocyanate or a chelate compound. Rather, the Takeo patent suggests that isocyanate and chelate compounds are equivalent. The Takeo patent further provides a list of possible elements for use in a formula, but fails to recognize any benefits from the use of one allegedly equivalent element over another. However, the Takeo patent fails to recognize any improvement in the pot life of a thermosetting and active energy ray curable resin composition.

7. The claimed invention yields unexpected results. In particular, the inventor has found that, surprisingly, an isocyanate and a chelate compound do not produce equivalent reactions as a crosslinking effect with respect to the above-mentioned polymer of the claimed invention. Improvement in the pot life of a thermosetting and active energy ray curable resin composition is an effect provided by the claimed invention that is remarkably unpredictable and unexpected to a person of ordinary skilled in the art.

8. Such a highly-unpredictable effect is demonstrated by a comparison of Example 8 and Comparative Example 5 as set forth in the present specification as originally filed. What these Examples show is as follows.

- (1) In Example 8 and Comparative Example 5, transfer materials are produced by;
 - (i) preparing solutions of the resin compositions in question, the first solution being the above-mentioned polymer with a metal chelate compound as in Example 8, the second solution being the above-mentioned polymer with a polyfunctional isocyanate as in Comparative Example 5),
 - (ii) applying the solutions to separate base sheets by printing, and then
 - (iii) curing the applied solutions on the base sheets.

9. The work life shown in Table 1 (see page 26 of specification as originally filed) confirms that usable time of the two examples discussed above (i) differ significantly. Specifically, the work life of the solution with the metal chelate compound (Example 8) is

triple the work life of the solution with the isocyanate (Comparative Example 5) ("24 hours or more" vs. "8 hours or less"). Thus, isocyanate compounds and chelate compounds are not equivalent and *do not* produce the same results, contrary to the alleged teachings of the Takao patent.

10. The improved work life of Example 8 (having a chelate compound free of isocyanate groups) is three times greater than that of the work life of Comparative Example 5 (includes an isocyanate group) thus improving workability in producing a transfer material, which is an unexpected result. There is no indication or suggestion of such a result in the teachings of the Takao patent. Rather, the Takao patent teaches that chelate compounds and isocyanate compounds are equivalent or interchangeable. Applicant's data, on the other hand, shows clearly that chelate compounds and isocyanate compounds are *not* equivalent nor are they interchangeable.

11. The difference of work life is related to control of reactivity between the polymer and the heat curing agent. The claimed invention unpredictably improves not only workability simply owing to the long work life but also productivity of the transfer material itself. In Example 8,

The protective layer was *semi-cured* by heating at 150° C. for 30 seconds. An image layer and an adhesive layer were sequentially formed of an acrylic ink and an acrylic resin, respectively, by gravure printing to obtain a transfer material 1. (See page 22 lines 17-25 of the specification as originally filed).

That is, the crosslinking reaction was progressed by heating for a very short time (at 150° Celsius for 30 seconds) after applying the solution of the resin composition on the base sheet. Productivity of the transfer material can remarkably be improved by completing crosslinking reaction by heating for such a short time.

12. Although a crosslinking reaction was also carried out by heating in the same manner in Comparative Example 5, the resin composition with the above-mentioned polymer *and* a polyfunctional isocyanate compound provided only a very short work life of "8 hours or less". If a resin composition including a polyfunctional isocyanate compound had a long work life, it would cause weakness of reactivity between the polyfunctional isocyanate group

and the hydroxyl group making it difficult or impossible to obtain a crosslinking reaction by heating for only a very short time, such as 30 seconds.

13. In other words, by using a chelate compound that is free of compounds containing one or more isocyanate groups, as in the claimed invention:

- (i) the work life is extended with respect to application to a base layer when a transfer material is produced,
- (ii) a crosslinking reaction with a chelate compound can be effected in a very short period of time,
- (iii) such complete crosslinking reaction improves resistance to further chemical reaction.

That is, reactivity can be freely controlled by using the resin composition of the claimed invention.

14. On the other hand, it is well-known in the art (and also specifically taught by the Takao patent at Column 11, lines 40-42 of the Takao patent) that catalysts typically control reactivity between a hydroxyl group and a polyfunctional isocyanate. The undersigned ran experiments to determine whether or not the work life of the claimed invention could be extended by controlling reactivity using such a catalyst. The undersigned believed that the control of reactivity would significantly affect the progress of crosslinking reaction, and sufficient curing would not progress by instant heating. Also, the weakness of reactivity considerably affects chemical resistance. These conclusions are supported by the data tabulated in the table below:

EXPERIMENTAL DATA

	Experiment 1	Experiment 2	Experiment 3
Crosslinking agent: isocyanate	No-catalyst	0.2 % of catalyst with respect to total amount of polymer	0.5% of catalyst with respect to total amount of polymer
Pot life (temp. 25 ° C)	24 hours or more	8 hours	4 hours
Heat curing 150 ° C, 30 sec.	Solvent resistance X	Solvent resistance △	Solvent resistance ○
Heat curing 150 ° C, 4 hours	Solvent resistance ○	Solvent resistance ○	

In the table above, X , △; and ○correspond to the meaning on page 26, lines 6-9 of the specification, as originally filed. Experiments 1, 2 and 3 (above) all use the polymer as set forth in claim 1 of the instant application, but use isocyanate as the heat curing agent. Experiments 1, 2 and 3 (above) were all performed in the manner set forth in the Comparative Example 5 and the test Examples of the present specification except that with Experiments 2 and 3 the above specified amount of catalyst was included.

15. From the above table of data, the difference of work life between Comparative Example 5 (using an isocyanate with a catalyst) with a work life of 8 hours or less and Example 8 (using a chelate compound) with a work life of 24 hours or more affects not only the difference of working time but also the subsequent process of completing productivity of the transfer material and features of the transfer material.

16. The use of a chelate compound also as a crosslinking agent provides an unpredictable effect other than the difference of work life, and this would not be obvious to a person skilled in the art from the Takao patent. Instead, the Takao patent teaches that the curing reaction must have a catalyst. The above Experiments show that use of a catalyst has a negative effect on the resin composition recited in Applicant's claims.

17. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,


HIROYUKI HOSOI

Dated: January 21, 2011

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